

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

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| MEDB# and Title: | MEDB 5.3 Isokinetic Testing |
| Sponsor: | Medical Operations |
| Discipline: | Bone, Muscle & Exercise |
| Category: | Medical Requirements (MR) |
| References: | International Space Station Medical Operations Requirements Document (ISS MORD), SSP 50260 Medical Evaluation Documents (MED) Volume B 5.3 |
| Purpose/Objectives: | To provide an objective measure of pre- and postflight muscle strength and endurance in select muscle groups for the evaluation of inflight countermeasures and postflight rehabilitation. |
| Measurement Parameters: | Isokinetic peak torque (strength) and total work (endurance) |
| Deliverables: | Assessment of muscle strength and endurance |
| Flight Duration: | ≥30 days |
| Number of Flights: | Every Expedition |
| Number and Type of Crew Members Required: | All primary U.S. crewmembers. Back-up crew will only complete preflight MATs greater than L-45 days unless specifically waived by crew surgeon. If crew swap does occur, back-up crew will complete all preflight MATs |
| Other Flight Characteristics: | N/A |

3.3 Preflight Training – No Preflight Training

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

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| Preflight Activity | Description: | Muscle performance testing will be administered using a standard clinical isokinetic dynamometer on selected muscle groups. A standard protocol for warm-up prior to testing will be followed for each muscle group. Testing will be performed on the right limb. <ul style="list-style-type: none">▪ Concentric knee extension and flexion - Seated 60°/sec 5 reps 180°/sec 21 reps - endurance▪ Concentric ankle plantarflexion and dorsiflexion - Prone 30°/sec 5 reps▪ Eccentric ankle plantarflexion and dorsiflexion - Prone 30° /sec, 5 reps▪ Concentric back extension and flexion - Standing 60°/sec 5 reps | | | |
| | Schedule: | Duration: | Schedule: | Flexibility: | Personnel Required: |
| | | 75 minutes 60 minutes | L-180 Familiarization & sizing L-90/60 MAT | +/- 5 Days NA | Lab personnel/ Crewmember |
| | Ground Support Requirements Hardware/Software | Preflight Hardware: | Preflight Software: | Test Location: | |
| Isokinetic Dynamometer | | NA | U.S. and Russia | | |
| Testing Facilities | Minimum room dimensions: | Number of electrical outlets: | Temperature requirements: | Special lighting: | |
| | Approximately 15 x 15 feet | One 220V and two 110V (US) Three 220V with two conversion to 110V (Russia) | 20 -25 °C | N/A | |
| | Hot or cold running water: | Privacy requirements: | Other: | | |
| | NA | Access to room must be controlled during testing. | Crash cart will be available in the building while testing is being conducted and 2 BLS operators will be present at all times. | | |
| Constraints/Special Requirements: | <ul style="list-style-type: none">▪ No max exercise 24 hrs prior to testing; no exercise 8 hrs prior to testing. Interaction with other tests (MAT or science), HRF experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon.▪ No food 2 hrs prior to test▪ No caffeine, alcohol, or nicotine 8 hrs prior to test▪ Contraindications: previous musculoskeletal injury (use left limb)▪ No neutral buoyancy training 48 hours (prefer 72 hours) prior to test (Preflight only); prefer no neutral buoyancy training 24 hours after test▪ Speed and torque calibration must be performed on test day | | | | |

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| | <ul style="list-style-type: none"> No physical testing or physical training will be conducted with the crewmembers within 72 hours of returning from overseas travel. No physical testing or physical training will be conducted with the crewmembers within 48 hours of domestic travel unless approved by the Crew Surgeon. <p>Test Termination Criteria:</p> <ul style="list-style-type: none"> Volitional Fatigue Pain Lightheadedness, dizziness, or other symptoms of orthostatic hypotension. Muscle strain, joint sprain |
| Launch Delay Requirements: | <ul style="list-style-type: none"> L-45/30 data collection will be repeated if launch is delayed by more than 3 months. When a crewmember serves as a back-up for a flight and later becomes prime for another, the L-180 test will be repeated if the last test as a back-up is not within one year of the selected launch date as a prime crewmember. |
| Notes: | None |
| Data Delivery | <p>Data/Report to Designated Recipients (Nominal/Contingency):</p> <p>Preliminary MAT reports for all preflight sessions will be delivered to Crew Surgeon via Mission Integration Coordinator (MIC) within 48 hours of test completion. A final report is due to the Crew Surgeon and Data Archivist within 14 days after completion of final postflight MAT.</p> |

3.5 In-Flight Activities – No In-Flight Activities

3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

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|--|---|---|---|--------------|---|-------------------|
| Postflight Activity | Description: | Muscle performance testing will be administered using a standard clinical isokinetic dynamometer on selected muscle groups. A standard protocol for warm-up prior to testing will be followed for each muscle group. Testing will be performed on the right limb. <ul style="list-style-type: none">▪ Concentric knee extension and flexion - Seated 60°/sec 5 reps 180°/sec 21 reps - endurance▪ Concentric ankle plantarflexion and dorsiflexion - Prone 30°/sec 5 reps▪ Eccentric ankle plantarflexion and dorsiflexion - Prone 30° /sec, 5 reps▪ Concentric back extension and flexion - Standing 60°/sec 5 reps | | | | |
| | Schedule: | Duration: | Schedule: | Flexibility: | Personnel Required: | |
| | | 60 minutes | R+5/7 MAT (Knee & Ankle) | +/- 2 Days | Lab personnel/ Crewmember | |
| | | 60 minutes | R+5/7 MAT (Knee, Ankle & Back) | +/- 2 Days | | |
| 60 minutes | R+30* MAT (Knee, Ankle & Back) (See Special Req.) | +/- 2 Days | | | | |
| Ground Support Requirements Hardware/Software | Postflight Hardware: | | Postflight Software: | | Test Location: | |
| | Isokinetic Dynamometer | | NA | | U.S and Russia | |
| Testing Facilities | Minimum room dimensions: | | Number of electrical outlets: | | Temperature requirements: | Special lighting: |
| | Approximately 15 x 15 feet | | One 220V and two 110V (US) Three 220V with two conversion to 110V (Russia) | | 20 -25 °C | N/A |
| | Hot or cold running water: | | Privacy requirements: | | Other: | |
| | NA | | Access to room must be controlled during testing. | | Crash cart will be available in the building while testing is being conducted and 2 BLS operators will be present at all times. | |

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| Constraints/Special Requirements: | <p>*If crewmember has not returned to preflight baseline at R+30, testing may be repeated every 15 days at the discretion of the crew surgeon.</p> <ul style="list-style-type: none"> ▪ No max exercise 24 hrs prior to testing; no exercise 8 hrs prior to testing. Interaction with other tests (MAT or science), HRF experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon. ▪ No food 2 hrs prior to test ▪ No caffeine, alcohol, or nicotine 8 hrs prior to test • Contraindications: previous musculoskeletal injury or pain (use left limb) ▪ MR079L to occur 2-4 hours prior to MR078L: Functional Fitness ▪ Speed and torque calibration must be performed on test day ▪ No physical testing or physical training will be conducted with the crewmembers within 72 hours of returning from overseas travel. ▪ No physical testing or physical training will be conducted with the crewmembers within 48 hours of domestic travel unless approved by the Crew Surgeon. <p>Test Termination Criteria:</p> <ul style="list-style-type: none"> ▪ Volitional Fatigue ▪ Pain ▪ Lightheadedness, dizziness, or other symptoms of orthostatic hypotension. ▪ Muscle strain, joint sprain |
| Early Destow / Early Return: | N/A |
| Notes: | N/A |
| Data Delivery | Data/Report to Designated Recipients (Nominal/Contingency): |
| | Preliminary MAT reports for all postflight sessions will be delivered to Crew Surgeon via Mission Integration Coordinator (MIC) within 48 hours of test completion. A final report is due to the Crew Surgeon and Data Archivist within 14 days after completion of final postflight MAT. |

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

| ACTIVITY | DURATION | SCHEDULE | FLEXIBILITY | PERSONNEL REQUIRED | CONSTRAINTS |
|--------------------|--|--|--|------------------------------|-------------|
| Preflight | | | | | |
| Isokinetic Testing | 75 minutes 60 minutes | L-180 Familiarization & sizing L-90/60 MAT (Knee, Ankle & Back) | +/- 5 Days NA | Lab personnel/ Crewmember | See Note |
| Postflight | | | | | |
| Isokinetic Testing | 60 minutes 60 minutes 60 minutes | R+5/7 MAT (Knee & Ankle) R+5/7 MAT (Knee, Ankle & Back) R+30* MAT (Knee, Ankle and Back) | +/- 2 Days +/- 2 Days +/- 2 Days | Lab personnel/ Crewmember | See Note |

*If crewmember has not returned to preflight baseline at R+30, testing may be repeated every 15 days at the discretion of the crew surgeon.

Note:

- No max exercise 24 hrs prior to testing; no exercise 8 hrs prior to testing. Interaction with other tests (MAT or science), HRF experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon.
- No food 2 hrs prior to test
- No caffeine, alcohol, or nicotine 8 hrs prior to test
- Contraindications: previous musculoskeletal injury (use left limb)
 - No neutral buoyancy training 48 hours (prefer 72 hours) prior to test (Preflight only); prefer no neutral buoyancy training 24 hours after test;
- Speed and torque calibration must be performed on test day
- No physical testing or physical training will be conducted with the crewmembers within 72 hours of returning from overseas travel.
- No physical testing or physical training will be conducted with the crewmembers within 48 hours of domestic travel unless approved by the Crew Surgeon.

Test Termination Criteria:

- Volitional Fatigue
- Pain
- Lightheadedness, dizziness, or other symptoms of orthostatic hypotension.
- Muscle strain, joint sprain